“She will be the finest liner of her type ever built… It is our intention to incorporate every modern idea that will pass the stern scrutiny of practicability.”

Vessel Description

- Large Back Deck
- Adaptable Centerboard
- Customizable Labs
- Accessible Masts
- Matable Van Vestibule
- OHS swappable spools & variety of TM’s and deployment options
- Optimized Hull / Bulbous bow
- Waste Heat Recovery
- Variable Speed Power Generation
- Wake Adapted Propellers
- Ultra Efficient Pumps / Motors
- LEDs and smart energy use features
- Push/Pull Z-Drives

- Dynamic Positioning with two stern and two bow thrusters
- U-Tube, Ctr Board, Fins, Beam
- Wide suite of SONAR options
- Sign Focus
- Double articulated Frames
- European Influenced
- Individual Staterooms
- As strong a crane as stability allows
- Miranda Style Davit for small boat launches
design
- Acoustically Quiet
- Virtual Participation through Data/Telepresence

- Versatile • Capable • Efficient • Desirable
Other Design Drivers

- ABS Ice Class: C0
- ABS DP Class: DPS-1
- Enviro Certified: Green Marine & IAPH Environmental Ship Index
- ADA Informed design components
General Arrangement

<table>
<thead>
<tr>
<th>Area</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Lab</td>
<td>520 ft²</td>
</tr>
<tr>
<td>Wet Lab</td>
<td>275 ft²</td>
</tr>
<tr>
<td>Computer Lab</td>
<td>175 ft²</td>
</tr>
<tr>
<td>Main Deck (aft of house)</td>
<td>2,100 ft²</td>
</tr>
<tr>
<td>Main Working Deck (including side deck)</td>
<td>2,373 ft²</td>
</tr>
<tr>
<td>Side Deck Length</td>
<td>77 ft</td>
</tr>
<tr>
<td>Space on the port side for two vans (mated to superstructure)</td>
<td>77 ft</td>
</tr>
</tbody>
</table>
General Arrangement

01 Level

Telepresence Center 235 ft²
Winch Deck Area 550 ft²

Science Berths
8 Double Staterooms (includes accessible stateroom on Main Deck)

Marine Technician 1 Double Stateroom
Hull Form

- Modified Bulbous Bow
  - Increases fuel efficiency by up to 6% at cruise speed
- Weight: Greater requires more power
  - Lightweight Construction Materials

Length of Waterline 178' - 0"
Breadth, Molded 41' - 0"
Depth, Molded 19' - 0"
Design Draft 12' - 6"

Hull Coefficients
Prismatic 0.622
Maximum Section 0.931
Block 0.579
Waterplane 0.803
7.0 Knots
Variable Speed DC Power Generation

• Increase Fuel Efficiency
  • Variable Speed Power Generation
  • Power electronics produce 60Hz power
  • Optimal operating point
  • Increased fuel economy, especially at light loads
  • Observations indicate 5%-15% fuel savings
**Sea Keeping**

Operability
- Max Roll Displacement: 3° RMS
- Max Pitch Displacement: 2° RMS
- Max Lateral Acceleration: 0.05g
- Max Vertical Acceleration: 0.15g
Propeller

• Using Schottel STP Twin Propeller
  – Push/Pull, ducted, single shaft
  – Lower RPM (reduces cavitation, increases efficiency)
  – Greater surface area (increases efficiency and bollard pull)

• 4 Propellers are individually “wake adapted” for maximum efficiency.
  – Think of prop as a “wing” not a “screw”
Flow Through Sensors

- Surface Salinity
- Surface Temperature
- Light Transmission
- Dissolved Oxygen
- pH/ Oxidation Reduction Potential
- Chlorophyll
- Phycoerythrin or Rhodamine
- Phycocyanin
- Colored Dissolved Organic Matter
- Turbidity- Red, Blue and Green Scattering
- Nitrate
- Total CO$_2$ and pCO$_2$
- Irradiance
Linking Scientists to Quality Real Time Data

Data Handler & Acquisition System

Continuous Data Collection Platform

Real Time Data

Operational Input
Monitoring
Outreach
Remote Sensing Validation

Flow Through & Met Sensors

Quality Control

Linking Scientists to Quality Real Time Data

Continuous Data Collection Platform
RCRV Centerboard Concept

- 200 kHz
- 18 kHz
- EM 2040
- 38 kHz
- 70 kHz
- 333 kHz
- 120 kHz
New R/V Sikuliacq Stern A-Frame Design

UNOLS “Standard Bolting Flange”

Built to UNOLS “App B” Standards (DLT=120kip)

Removable / Swappable Wings

Rotating Trunnion Style Cross Beam
A little inspiration
Pre-OSU Interior Design Consultant

Representative Crew State Room (Grumpy AB not included)
Conclusions

• RCRV: Regional Class Research Vessels to meet national coastal ocean priorities within the 21st Century
• Much input from the science community has led to several innovations in the next generation RCRV science support systems.
• Close monitoring of the maritime industry has led to the incorporation of several next generation technologies used to improve efficacy and performance.
BACKUP SLIDES
## Propulsion System / Power Generation

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Total Load kW</th>
<th># Gens On-Line</th>
<th>% Gen Load</th>
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</thead>
<tbody>
<tr>
<td>Transit Summer</td>
<td>1242</td>
<td>2</td>
<td>79%</td>
</tr>
<tr>
<td>Transit Winter</td>
<td>1300</td>
<td>2</td>
<td>84%</td>
</tr>
<tr>
<td>Transit Temperate</td>
<td>1216</td>
<td>2</td>
<td>78%</td>
</tr>
<tr>
<td>Full Speed</td>
<td>1760</td>
<td>3</td>
<td>73%</td>
</tr>
<tr>
<td>Heavy DP</td>
<td>1446</td>
<td>2</td>
<td>93%</td>
</tr>
<tr>
<td>Towing</td>
<td>1195</td>
<td>2</td>
<td>77%</td>
</tr>
<tr>
<td>In Port</td>
<td>248</td>
<td>1</td>
<td>37%</td>
</tr>
<tr>
<td>Emergency</td>
<td>143</td>
<td>E-Gen</td>
<td>97%</td>
</tr>
</tbody>
</table>
RCRV High Level Schedule

**R&RA**

- **Phase I-A**
  - 12/13/12 to 12/31/17 (12/13/12-3/31/17)
  - 12/31/15

- **Phase I-B**
  - 8/5/14

- **Phase I-C**
  - 7/17/15

  - NSF Vessel # Determination
  - NSF Approval for Inclusion in MREFC Budget

**Phase II**

- 1/1/16
- Acquisition
- 3/31/17
- FDR
- 2/7/17

**MREFC**

- 4/1/17 - 9/30/23 (4/1/17-9/30/23)
- 12/31/21

**Hull 1**

- 4/1/17
- Keel Laying
- 5/8/18

- 8/15/19
- Launch
- 7/20/20
- Delivery

- 7/23/19
- Contract Closeout

- 7/20/21
- Transition to Operations

- 7/20/21
- UNOLS Designation

- 12/31/22
- Construction and Delivery

**Hull 2**

- 4/1/18
- Keel Laying
- 3/27/19

- 6/30/20
- Launch
- 7/28/21
- Delivery

- 7/16/20
- Contract Closeout

- 7/31/22
- Transition to Operations

- 7/31/22
- UNOLS Designation

- 12/31/22
- Construction and Delivery

**Hull 3**

- 4/1/19 - 9/30/23 (4/1/19-9/30/23)

- 12/31/19
- Keel Laying

- 4/30/21
- Launch
- 3/31/22
- Delivery

- 4/1/23
- Contract Closeout

- 4/1/23
- Transition to Operations

- 4/1/23
- UNOLS Designation

**Phase III PM**

- NSF OI Selection
- 11/1/17

Saved: 1/13/2015
Green Ship Initiatives

Top Three Green Ship Initiatives
• Hull form optimization (reduced powering by ~10% from baseline hull)
• Variable Speed Generators (space reduction, 5-15% reduction in fuel consumption)
• Waste Heat Recovery (~350kW savings)

Other Green Ship Initiatives
• Wake adapted propellers, Twin propeller Z-drives
• Permanent magnet alternators and Z-drive motors, premium efficiency motors, VFD pumps & fans, LED Lighting
• Fire suppression (Novec 1230), non-ozone depleting refrigerants
• Biologic MSD, 5PPM oily water separator, fuel overflow system, environmentally acceptable lubricants, ballast water treatment, EPA Tier 4 engines, solid waste storage
• Hull coating – no biocide toxin release
• Biodiesel is a fuel option that can be used.